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Martin Rees



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A Lost Treasure!

The current output of globally-published literature is sometimes out-of-context for being effective (on the local level), in underprivileged countries. Thus, it is essential for these countries to establish a framework for which to use the knowledge that is published by the global scientific community in a local context. For this reason, such countries should be given the opportunity to publish their own research in a scientific journal. The “journal”, be it in paper or electronic format, is vital since it serves as a major medium for the dissemination and exchange of expert information. It may even provide a gateway for collaboration between authors across different disciplines.

According to an article by Gibbs in Scientific American, only 2% of the international-community’s scientific publishing comes from developing countries. In fact, considering that such countries constitute almost 80% of the world’s population, their scientific contribution is clearly far too small to be accounted for. Perhaps the reason for this trend is that journals in developing countries face rather fundamental difficulties as opposed to mainstream journals in developed countries. For example, the latter journals often run into problems associated with conflicting interests, authorship and general ethical issues, while the former journals struggle with logistical issues, such as attracting original (high quality) articles and the lack of “know-how” for managing a general publication.

Seeking a respected position among the hundreds of journals, IBScientific aims to bring its readers something new by taking the best from both worlds. Since its launch last year

(with this issue marking its first anniversary), IBScientific has adopted an open-access philosophy right from the start. Unlike other open-access journals, IBScientific does not charge for manuscript submission. In addition, it offers free readership to everyone, hoping to make it a truly accessible scientific resource for the World.

Indeed, many of these topics, and others relating to science, technology and publishing will be further discussed by an expert panel in the IBScientific First Annual Conference (IBSAC 2006) on 8th July. Moreover, an account of the IBScientific team’s experiences, their current difficulties and their suggested solutions will be provided before closing the day’s session.

Nevertheless, in this issue of IBScientific, the editorial team is thrilled to bring its readers a conference special edition featuring selected abstracts submitted for the conference day and an exclusive interview with Prof. Rees, who highlights some of his experiences in the fields of science and academia. Furthermore, the readers will note the debut of the first social-science articles in IBScientific, hence paving the way to an even more interdisciplinary publication. The IBScientific team hopes that its faithful readers will accept its invitation. Remember, only together can we look forward to finding that lost treasure again....

Abdeldjalil BENNECER
IBScientific Chief Reviewer

IBScientific

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Physics

Apply Pressure Until Something Breaks

WITH pressure of 10 terapascals (10^{13} Pa) about 20 times the pressure of the Earth's core, a laser pulse has created two tiny holes in a pure sapphire. Physicists think that the laser can drive temperature to increase at new record-breaking rate of 1018 degrees per second which tops the previous fastest heating record. The experiment made an explosion as described by the authors [1] and the intense heating power, which lasted for only a couple of hundred of femtosecond (1015 second), has raised the temperature to about half a million °C. The success shows that conventional tabletop lasers could soon find their way to simulate the high pressure conditions at the core of the planets or possibly even trigger fusion reactions which often required more powerful lasers, though these latter are large and involve specialised facilities.

Such results have been previously reported mainly using laser pulses to drill holes through materials; however, Tikhonchuk says that they are the first to report the pressure and temperatures involved in those cases, which may well rank them in the first row. "We have also focused the pulse to a much smaller size," he adds. "Because of that we have a very high energy delivery."

Based on the size and the shape left by the blast of the laser light on the pure sapphire, Tikhonchuk calculated the intense heating power. Juodkazis (Hokkaido University, Japan) conducted the experiment. The laser pulses lasted only for 200 femtosecond enough time for pure sapphire to explode but as the ball of shredded atoms grew bigger making it less dense, any further heating would not reach the initial pressure rendering it less efficient.

"The trick is to heat the plasma before it starts to expand," says Tikhonchuk.

Although this is the fastest temperature rise rate ever reported yet, the Z machine at Sandia National Laboratories, Albuquerque, New Mexico, used to create conditions of atomic fusion, still holds the title of the highest temperature. Scientists at the same laboratory reported earlier this year that their experiment has reached 2 billion °C [2].

A.B. Source: Nature, 12 May 2006; doi:10.1038.

Repulsive Atoms Trapped in a Forced Marriage

A remarkable progress has been made in the field of Bose-Einstein Condensation (BEC¹) over the last decade or so. Research into the properties of ultracold atoms is about to enter a new era. In a letter to Nature [3], Physicists from Austria have created a new type of stable atom pairs from otherwise a repulsive combination. A team led by Johannes Hecker Denschlag and Andrew Daley at the University of Innsbruck have shown that in special environment of 3D optical lattice, created by the interference of three counter propagating laser beam-pairs yielding to standing waves conditions, these odd atom couple can be trapped (see figure 1).

This is a strange and counterintuitive result because bringing two repulsing objects together will just make them accelerate from each other. Now, however, Denschlag and colleagues have demonstrated that rubidium atoms can stick together even though there is no attractive force between them. This finding is the latest oddity to emerge from physicists who have not ceased to unveil more secrets

about the BEC.

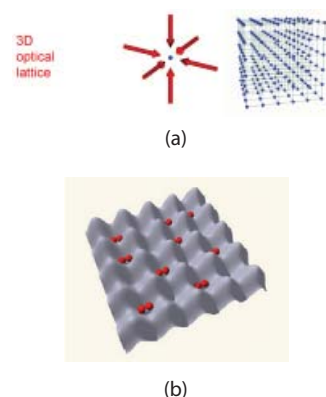


Figure 1: (a) 3D optical lattice (b) Repulsion between pairs of identical rubidium atoms in an artificial optical lattice causes them to be stable against separation (image courtesy: Nature 441 821)

For the experiments, the Austrian team have prepared a sample of ultracold atoms from rubidium-87 from BEC. Then, the sample was loaded into 3D optical lattice and with the help of a so-called Feshbach resonance; they were able to control the molecules to form two-atoms or none in the bright spots. After removing the applied magnetic field, they were surprised to find that strongly repelling atoms still bind together despite the dragging force.

According to the team, repulsion between a pair of atoms is explained by an extra energy as if they were connected by a compressed spring which pushes each molecule apart. Once they separate, the extra energy is transferred into kinetic energy. However, in the optical lattice environment, atoms can only move to discrete levels of energy as predicted by quantum mechanics laws and just as electrons do. Therefore, if the spacing and the brightness between the beam spots are carefully tuned, the atom pairs need to enter forbidden states of energy in order to separate. In

other words, the separated atoms would have energy bands that fall between the allowed bands in the lattice environment. This means they must stay bound together and hop from one potential well to another in pairs.

"Our findings are also relevant for current research on how to build a quantum computer, and especially in how to use atoms in optical lattices to model very complicated systems from solid-state physics," says Daley, who is a theorist. "For example, atoms in an optical lattice can be made to behave like electrons in the lattice structure of solid-state materials." Similar experiments could help explain high-temperature superconductivity or even reveal other stranger other phenomena in the crystal world.

A.B. Source: PhysicsWeb "Repulsion binds atoms" 15 June 2006.

Material Science

Making Water

The Namib fog beetle is a feisty little creature. Every morning he makes an arduous journey to the top of a sand dune, where he turns his body into the wind, straightens out his rear legs and lowers his head. The fog rolling in from the sea gradually collects on his back, forming droplets of water, which glide downwards and hang from the insect's mouthparts. In this way, he is always assured of a healthy morning drink, despite being miles from the nearest fresh water. (*ScienceNOW*, 1 November

[1] S. Juodkazis *et al.* Phys. Rev. Lett. , 96, 166101 (2006).

[2] M.G. Haines *et al.* Phys. Rev. Lett., 96, 075003 (2006).

[3] Repulsively bound atom pairs in an optical lattice K. Winkler, G. Thalhammer, F. Lang, R. Grimm, J. Hecker Denschlag, and A. J. Daley, A. Kantian, H. P. Büchler, P. Zoller. Nature 441, 853-856, (15 June 2006), doi:10.1038/nature04918.

¹ According to the laws of quantum mechanics, when atoms are cooled to a millionth of a degree, they weirdly crowd into a single quantum state that gives matter laser-like properties.

2001).

Scientists were inspired by such a little creature to design a nanomaterial that literally plucks moisture from the air. Such an invention can boost water supplies in desert and drought prone areas. Materials scientist Michael Rubner, chemical engineer Robert Cohen, and colleagues at the Massachusetts Institute of Technology in Cambridge designed a rough coating so hydrophobic (water repelling) that water sprayed onto it stood up in nearly spherical droplets. First, they wrinkled polymer films onto glass to create micrometer-sized hills and valleys. Then, to prevent droplets from getting trapped in the valleys, the team decorated the surface with glass nanoparticles coated with water-repellent Teflon-like molecules. To make the material capture rather than shed water, the researchers took another cue from the *Stenocara* beetle. They created water-grabbing bumps with charged polymers that are full of pores and function "like a nanocapillary or a nanosponge that just sucks the water up," Rubner says.

The new material is much more efficient than current mist-catching nets, in which most of the water passes through uncollected, says Andrew Parker, the Oxford University zoologist who originally described the beetle's unique surface. "There is potential to help people's lives," he says.

"We made from water every living thing" Quran 21:3

M.A.T. Source: Science Magazine, 25 May 2006.

Information Technology

Google Takes on Science

IN a recent study, physicists in the US found Google Page rank, an algorithm to measure the relative importance of a webpage, can provide a systematic way to measure the impact of a scientific publication. The findings were very positive that some suggested the tool may replace traditional citation indices.

Traditionally, citation records use

the number of times a paper is cited by other authors to measure a particular importance of the findings. One example is Richard Feynman and Murray Gell-Mann's 1958 paper "Theory of the Fermi Interaction", which introduced a new theory that subsequently became the standard model of the weak interactions. This was one of the papers discovered with the new technique.

Using the Google Page Rank algorithm, such a technique can be used to unearth such papers. In their study, the researchers applied the algorithm to the entire network of citations for all the articles in the physical review family of journals published between 1893 to June 2003. The network in the experiment consists of 353,268 nodes, which represent all articles published during this time and 3,110,839 links that represent all citation to Physical Review. The algorithm launches many random walkers to the network of citations. In half the time, each walker jumps from a paper to one of its references each with equal probability and the rest of the time the walker jumps to random papers. This hopping process is repeated until the populations of random walkers at each node become statistically constant. The Google number represents the average number of walkers at a given time in the network.

It was found that results from the Page Rank searches are linearly correlated with those obtained from citation indices. Where, highly cited papers, also have high Google rank numbers. What was surprising is that this technique managed to find a few outliers, these are exceptional papers that have anomalously high Google rank numbers compared with their citation rank. Examples include the following citations:

*1933 Phys. Rev. Paper by Wigner and Seitz, "On the Constitution of Metallic Sodium" – the Wigner-Seitz construction appears in most solid-state textbooks;

*1957 Phys. Rev. Publication by Gell-Mann and Brueckner, "Correlation Energy of an Electron Gas at High Density", which is important for many-body theory;

*1963 Phys. Rev. Lett. Paper by Glauber, "Photon Correlations", recognized in last year's Nobel Prize

for physics

The team was very enthusiastic about the future, and stated clearly that Google rank may not only help organise the huge surge in scientific literature but more importantly may also be a more useful measure of scientific impact.

Some critics however argued that the technique should not become the only way to do the literature searches and that scientists should continue to randomly browse papers the old-fashioned way.

M.A.T. Source: PhysicsWorld and PhysicsWeb, Publications by the IoP (Institute of Physics).

Arabic Web Finally Under the Magnifiers

A new fully functional search engine for the World Wide Web dedicated for the Arabic language is planned for the end of 2006. The new product is an innovation of the Dubai based joint venture, founded by German Seekport and the Saudi Arabian MITSCO Group.

"Sawafi", Arabic for "Sandstroms", is specially designed to meet the challenges of the Arabic language and could set a tough challenge for international search giants such as Google, MSN and Yahoo, which currently offer a basic Arabic search facility.

The European Internet search specialist Seekport will provide the baseline technology, which will be expanded with the support of the local partners to meet the specific needs of the Arabic language. The search engine index will include all Arabic language websites, supported by English and French language contents from Arab countries. An important factor will be the adaptation of search to the specific needs of the Arabic user while addressing the numerous peculiarities and dialect variations

of the Arabic language.

Currently, there is not a full Arabic Internet search engine. Most existing ones involve a directory search, not a local search. Consequently, most websites in Arabic cannot be found by search engines. In addition to this, current search algorithms are not capable of observing the simplest morphological conditions required to process Arabic-language contents in a meaningful way for users.

Sawafi could then revolutionise the use of internet in the Arab world, an area with 280 million people but with very low internet usage. Estimates put the total number of Arabic websites at around 100 million at the present time, which counts for about 0.2% only of the total number of websites on the internet. Research conducted by the Dubai-based Internet researcher Madar shows that 65% of Arab internet users in 2005 could not read English and is expecting the number of Arabic Internet users to jump from 16 million (2004) to 43 million (2008).

Sawafi is hoping to copy the success of local Chinese language search engine Baidu, which has made huge strides in a market with over 100 million Web surfers. The philosophy is summarised by Havermann, the managing director of Seekport. He says: "There is not enough Arabic content available on the Internet. But there's no motivation to put more Arabic content on the Internet as long as you don't have a system to find the content."

S.N. Sources: Reuters.co.uk, April 25, 2006. Seekport.net.

Cancer Therapy

Run to Beat Cancer

TWO new studies report that physical exercise may protect against skin and bowel cancers.

This issue's news were collected by:

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However, the studies suggest different mechanisms that may underlie these similar findings.

In the first study [4], scientists exposed hairless female mice to ultraviolet B (UVB) light, which is known to induce skin tumours. The study found that mice, which were given a 24-hour access to a running wheel, developed fewer and smaller cancers than the control group that did not have access to a running wheel. Additionally, the runner-mice had a one third reduction in non-malignant tumours than the controls. Interestingly, in an experiment where the mice were exposed to UVB for a period before they were given a running-wheel, the tumours they had developed shrank by as much as 75% after a spate of regular running. These suggest that exercise delays and counteracts the effect on tumour development. Although all mice had an unlimited food supply, the running mice (which voluntarily run an average of two miles per day on their wheels) had less body-fat at the end of the study than the non-exercising control group.

The second study [5] looked at male mice with a genetic predisposition for developing pre-cancerous intestinal polyps. Half of the mice were kept on a calorie-restricted diet with access to a running-wheel, while a control group had an uncontrolled food supply but no wheel. In this study, the running mice had fewer and smaller polyps at the end of the 10-week study compared to those without the wheel. While six of the 23 control mice had died due to anaemia resulting from the number of polyps that had grown, all 24 exercising mice were alive at the end of the study. Surprisingly, however, the exercising mice had a lower body weight but retained more fat during the study than the controls. This is perhaps because the other mice were so sick they were wasting away, the author suggested. The next step in the research is to see what effect exercise alone has on polyp number and development, by allowing the mice to eat as much as they like.

Although both studies appear to show that exercise has a positive effect on reducing cancer burden, the researchers point out that the exact biological mechanisms are still unclear.

A.K. Sources: Various.

Launched officially by Roche in Algeria on 18 April 2006

Herceptin: the antibody that fights breast cancer and exploits patients

Theramedic, the official representative of the Suisse drug firm Roche in Algeria, has announced on 18 Apr 2006 the launching of Herceptin (Trastuzumab) in Algeria. Commercialised in the USA and Europe for few years now, this biological therapy, a monoclonal antibody is expected to benefit one quarter of breast cancer patients in Algeria, that is 1250 out of 5000 cases each year.

Herceptin is particularly useful for targeting aggressive forms of breast cancer, which manifests the over-expression of a cancer-causing gene, HER2. HER2 belongs to a family of genes called c-erbB-2 (otherwise known as her-2/neu) and expresses a tyrosine kinase receptor on the surface of cells, which when activated stimulates cell growth. Cells that overexpress this receptor can lead to breast cancer and may be specifically targeted for therapies such as Herceptin which involve specific monoclonal antibodies that specifically recognises and block excess HER2, thus stop tumour growth.

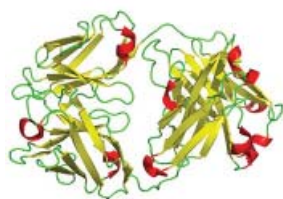


Figure 2: Cartoon model for the structure of Herceptin (Trastuzumab).
Source: Herceptin@3Dchem.com

According to Professor Kamal Bouzind, a consultant in the Centre Pierre et Marie Curie in Algiers, the new drug has already given promising results in a number of patients. Nevertheless, he explains that two conditions are required for an optimal efficacy for a Herceptin

treatment: early and accurate diagnosis, and large sums of money. For Hospital use, the drug is prohibitively expensive, one flacon costing 140,000 DA (\$2,000). Therapy, which requires 18 flacons annually, is therefore estimated to cost \$36,000 per patient. The government may be the only body capable of supporting such highly costing therapies, which concern a population of 1250 cases.

Despite its promises, experts warn that it is not a miracle drug. It has only lead to positive results in 50% of the women who have tested it. Nonetheless, they suggest, Herceptin combined with chemotherapy, doubles the chances for tumour regression. Dr Dennis Slamon, UCLA, whose 12-years work has led to the development of Herceptin has presented the drug as having the advantage of not causing the typical negative side effects of chemotherapy, including hair loss and decreased counts of white and red blood counts. To add to this, Herceptin could also be effective against certain types of cancer of the uterus, since 20% of women patients show similar genetic abnormalities.

Y.M. Source: El Watan, 19 April 2006. elwatan.com.

Energy/Economics

A Quick Glimpse at the Oil and Gas Sector Today

CRUDE oil prices above the US\$70 a barrel mark no longer surprise anyone nowadays; but what has caused the oil price to reach and remain at this level and what is the impact on the energy sector and beyond?

The phenomenal development of the once sleeping giant, namely China, and, to a lesser extent, India has dramatically increased the world demand on crude oil and natural gas. The crude oil price such as the price of any other commodity follows the rule of supply and demand and this is why crude oil prices have risen so much recently and would be sustained at these levels or even higher as long as the same trend prevails. Security fears associated with political unrest

in oil producing regions also affect the price of this commodity; however, recently this factor has had a relatively smaller impact.

The high oil price has allowed both national and multinational oil and gas companies to make record profits. In the case of national oil companies, these profits meant that large investments budgets became available for the revamp of existing installations to boost production as well as the instigation of new exploration and production projects and building new refineries and petrochemical plants. The treasuries of oil producing countries are also experiencing prosperous times. In a country such as Algeria, extensive economic, infrastructural and social projects have only been possible because of the high oil/gas prices. The multinational companies also increased their exploration and production efforts, often in joint ventures with national companies. The multinational companies are normally the owners of state of the art technology and their technical know-how and services are usually contracted by other parties, especially at present with so much investment in the energy sector taking place. Shell Global Solutions International, the technical consultancy of Royal Dutch Shell, for example, offers technical services and carries out new project designs for a variety of clients either fully Shell owned, joint ventures or third party business.

As well as investing in production and exploration, the multinationals have boosted their existing research efforts and extended their scope. The hot research topics include biofuels and CO₂ capture and sequestration. These topics are very important as they deal with sustainability of the environment that we all live in as well as the search for alternative sources of hydrocarbon fuels, which at the moment come mainly from finite fossil reserves.

In the face of the colossal profits that the large multinationals such as Exxon, Shell, BP and Total are making, it is natural for the governments of the countries where these companies have their headquarters

[4] L. Michna *et al.*, (2006) *Carcinogenesis*, Epublised.

[5] L.H. Colbert *et al.*, (2006) *Carcinogenesis*, Epublised.

to be tempted to impose additional taxes. Indeed such suggestions have been reported in the UK and France, for example. However, such actions are likely to be short-sighted. The nature of the business that is oil/gas exploration, production and processing is such that the capital investment is very large and the profit figures are normally dwarfed by the size of the investment. But more importantly, the rate at which the demand for fuel and energy is growing requires significant and consistent investment in finding new oil/gas reserves. The cost of developing new oil/gas wells is usually higher for the multinationals compared with the national companies as the latter have first choice of exploration/production sites in their home countries while the former usually have to settle for technically difficult sites made available by the governments of oil producing nations. Financial resources must also be available for research on novel sources of energy as well as advanced technology to protect the environment from the side effects of fossil fuel-derived energy usage, such as global warming and pollution.

To capitalise on the financial availability, oil/gas companies have set up plans for growth and expansion. However, a limiting factor is making the realisation of growth plans difficult, namely the lack of human resources. There are simply not enough qualified people in technical disciplines in Western Europe and North America to quench the thirst of the sector for this resource. Now the eyes are turned to the East, e.g. India and China, to find the much needed qualified work force. This is indeed the case of Shell which has opened a new technology centre in Bangalore, India. The centre will provide technical research, projects and services for upstream exploration and production, as well as downstream refinery and chemical operation. At full size, the centre will be employing a 1000 strong work force and will be relocated to a purpose-built campus by 2009. By March 2006 Shell had invested \$1 billion in India (tce, 2006).

While the oil/gas sector is experiencing a financially comfortable period with many stakeholders including the producing companies, support industries, and oil producing nations seeing large incomes,

no one should be complacent. With the energy demand estimated to grow by 50% in the next 25 years (Vikram Singh Metha, Shell India chairman, (tce, 2006)), the financial surplus of today must be employed to maintain the availability of conventional fossil fuels in the near and medium future and committed research must be carried out to find sustainable replacements. This may be the only strategy that would sustain the way and level of life that we know today.

M.S.E. Source: The Chemical Engineer, March 2006. Institution of Chemical Engineers, Issue 777, page 9.

Molecular Virology

Human H5N1: Blaming the Birds is Mischievous, the Court Ruled

BIRD flu is a menace that stalks our health every passing day, scientists are trying to solve its mysteries and combating it in different arenas. Some would try to stop its spread, others limit its fatal effects by drugs, and few are planning for vaccines.

This all may never be achieved efficiently if it was not for one theory; this theory states that the human and other mammalian forms of H5N1 are descendent of Bird Flu. Yes, this is just a hypothesis backed by data, and has achieved widespread recognition through the media. Granted, history, geography and other molecular data support very well, but one single branch of science has yet to be convinced.

Well, it is just one branch after all, true but very naïve. This branch is the one that assesses the relatedness of two genes and places them in a tree of ancestors and decedents. It is called phylogenetics.

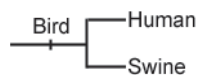


Figure 3

In this week's nature communications two letters question the

ancestral heritage of the 1918 human H5N1 [6, 7]. The first report [8] that sparks the debate suggested that mammalian H5N1 (primarily human and swine) are descendents of the Bird Flu virus by means of comparing their polymerase genes (see figure 3). This is important as tackling the current situation can be first assessed in birds. Another issue is the nature of the virus and the migratory patterns of birds' life style that can be translated into the current level of travels by humans. It is also possible to avoid disaster by eradication of the virus in birds as was seen in the case of foot and mouth.

The two new communications question this and put some efforts by government to effectively contain the virus in doubt. They suggest that the H5N1 virus coevolved (see Figure 4) in the three species separately and the endemic may not be averted by simply eradicating birds or containing the virus in this species.



Figure 4

They achieved this by using the same data as the original article, but they showed that the data may actually be interpreted better by putting the bird flu at the branches rather than the root of the family tree.

The original authors did reply [9] maintaining that the data was corroborated by historical and epidemiological studies, hence the conclusions. Also, they further provided an extended family of the virus showing the ancestry of the bird's virus as compared to the others. This does not fully answer concerns as much as it deviates the readers towards the credibility of the results to be published in nature.

Where does this leave us? Not to

worry. It seems to be merely academic and methods may be soon in place to effectively tackle the Flu may not be affected. As if nature not to be outdone another report in the advanced online publication [10], tackle the problem from an epidemiological perspective (independent of the H5N1 origin). This letter uses data from the UK and USA to determine best approaches to tackle the epidemic.

The value of these communications is immense as it provides strong evidence for need of understanding the nature of science, and how it works. It is also a very good example for interpreting results, and that the same results can be interpreted differently. This may not solve the problem of H5N1 origin, and we may never know for sure, but then this is science there is no 100%.

A.E. Sources: Various.

Pharmaceuticals

At last! The First Lot of Algerian Insulin Hit the Market



SAIDAL, one of Algeria's leading pharmaceutical firms, has announced the production of the first lot of Insudal; the commercial name chosen for the Algerian made insulin. The manufacturing was set to take place at the new Saidal production plant in the city of Constantine (East of Algeria).

Saidal has confirmed that the first batches destined for commercial use, have already been received, on the 17 of May of this year, by the

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different distribution points of the company. "Since its launching, the

factory has produced an adequate first stock of Insudal to insure the permanent availability of the product", the pharmaceutical group has pointed.

Insudal is now available on the market, throughout the country, for an incontestable price of just 440 Algerian dinars (DA). We should recall that the Constantine Insulin Production Unit was inaugurated last April by the Algerian president, Mr. Abdel Aziz Bouteflika, in order to produce three types of injectable Insulin, with a target sale of 5 million units per annum.

The insulin production unit, the first of its kind on a national level,

was built on a total surface area of 13.000 m², at the Saidal site situated in "Palma", the industrial quarter of Constantine. The construction of this important insulin production plant, carried out in collaboration with Aventis Pharma laboratories (the 3rd largest pharmaceutical company worldwide), was launched in Mai 2004 and was completed a month earlier than predicted.

The pharmaceutical group, Saidal, stated that reducing the import bill of insulin, as well as guaranteeing the permanent availability of this essential product are among the main aims on its agenda. It is worth noting that over a million Algerian citizens are estimated to

suffer from Type I diabetes, and are hence dependent on a permanent supply with insulin. On the socio-economical level, 120 new jobs

were created in order to assure the well functioning of the new unit.

The Insulin Production Unit was entirely financed by Saidal, by up to 1.3 billion DA, part of which in hard currency estimated at 10 million Euros. However, the leaders of Saidal predict a turnover of up to 1.7 billion DA per annum.

A.S. Source: Le quotidien d'Oran, 18 May 2006. Figure source: http://www.agingresearch.org/living_longer/spring_04/images/insulin.jpg

Annular Eclipse: A Remake

From **Jamal MIMOUNI**

President Sirius Astronomy Association
Physics Department
Mentouri University of Constantine
Algeria
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Sir,

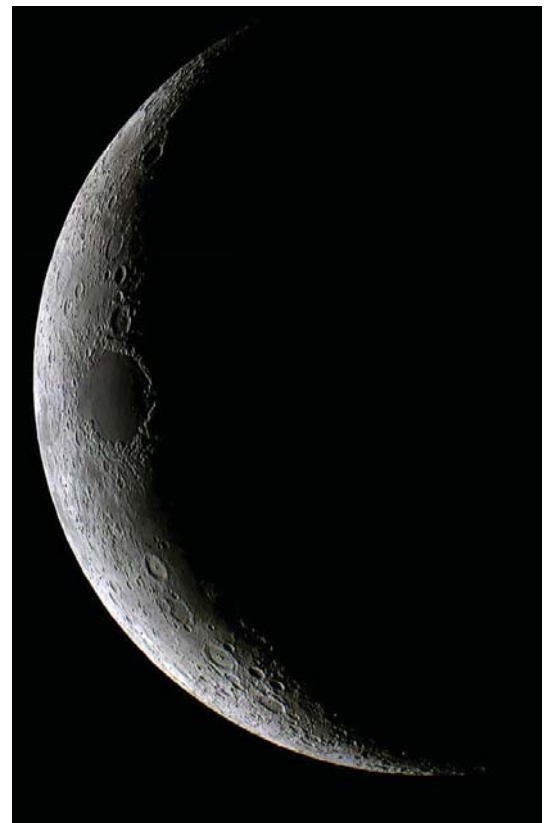
I am happy to report again to you on some science done here in Algeria. I noticed that you published in one of your past issues of IBS a comment on the Eid in Algeria (Bennecer, 2005). Here is more astronomical news. But before that I must say that I am truly impressed with the quality of your magazine; and that the bunch of Algerians/Maghrebans who stand behind it is even more incredible! It reminds me of another scientific review in the early eighties: *The Algerian Scientist*, which was put together by Algerian students abroad and to which I participated.

As a remake of the October 3, 2005 annular eclipse our Association was able to be on the national news in Algeria by organising a trans Maghreb caravan made of 45 people which crossed by land some 2500 Km to reach Jalu, Libya and observe the total solar eclipse of March 29 from there. The caravan made of 6 professors from 5 universities and amateurs from various parts of Algeria with ages ranging from 12 to 51 took two days to reach there. The travel is documented at: <http://www.siriusalgeria.org/eclipse2006>.

You may also check with profit the sighting campaign of the annular eclipse of October 3 2005 which created the event in Algeria at: <http://www.siriusalgeria.org/eclipse2005>, Sky & Telescope 3 October 2005.

Our Association is not unknown to the Astronomy community in the States. Some may recall that our Association created the surprise in winning an honourable place at the 1997 Astronomy Day (See the Reflector, Feb 1998), and a first prize in its category at the 2002 International Space Week.

Keep on the good work
Yours brotherly



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Clinical trials: Behind the Scene

From **Sihem BEGHOUL**

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Sir,

In recent years, there has been an increased interest in the conduct of clinical trials involving human volunteers. This is because they are the gold standard for testing the effectiveness and safety of drugs. In his article, which appeared in *IBScientific* magazine, Mehellou critically introduced clinical trials and their different phases (Mehellou, 2006a). In his second article, he discussed pharmacokinetics and their relevance to clinical trials (Mehellou, 2006b). These two articles clearly demonstrate the importance of clinical trials in evaluating the safety of drugs to be used in clinical practice.

In this brief commentary, I would like to look at this issue from a different angle and touch on briefly on what goes behind the scene while these trials are being conducted. As Mehellou pointed out, a drug or an intervention in a trial should pass through phases before it can be licensed for the treatment of patients. These phases involve the participation of healthy individuals and patients. At this point, some questions arise: how these individuals are being recruited to the study? Should we only concentrate our efforts on how the drug works and its effectiveness? Should we praise the investigators and award them the Nobel prizes and ignore the most important player in this gamble? The answer, to all of the above, is obviously NO! That is why before a clinical trial takes place, it should gain approval from an ethical committee. It was not until the aftermath of the World War II and the non-humane experiments conducted on the prisoners, that a set of rules known as the Nuremberg Code were introduced to ensure that recruits' rights were well protected. The Nuremberg code was and still is to some extent considered by many as the gold standard for the conduct of clinical trials.

As the need for volunteers are increasing with the reluctance of many of individuals in the western population, lot of interest has shifted towards recruiting patients from the developing countries. India is a very good example due to the huge population, and the ease of conducting trials. However, Human ego does sometimes go beyond limits and takes every minute opportunity to fulfil his needs. Despite the clear language of the Nuremberg code, some clinical trials are being conducted without maintaining good ethical practice in terms of informed consent,

in which the individual should be able to understand the basic requirements of the trial, be aware of the potential side effects and agree voluntarily to take part. The trial should not be an alternative to his/her medical care so much so that the recruit can have the right and autonomy to refuse to participate. Most of the developing countries have a high percentage of illiterate and poor people. This makes them very vulnerable to be abused and makes it easy for the investigators to convince them to take part in clinical trials. A valid informed consent is a crucial in the ethical approval of a trial. Recruits from developing countries may not fully understand the language of the country that conducted the trial. This means that the information is not fully understood by the recruits making the consent invalid. Another scenario is that a patient from a developing country may well be on a particular treatment and do reasonably well but because his/her condition is of a great interest to the trial, he may be recruited to a trial and the treatment being evaluated may worsen his/her condition. In this scenario, two important ethical principles are breached: beneficence and non-maleficence.

These comments are only for the purpose of revealing an aspect to the dark side of clinical trials in developing countries, which is often forgotten. This however does not mean that clinical trials are not necessary. They are indeed, and without them a drug cannot be safely introduced to the medical practice. The point which I would like to make is: Ethical issues should be taken seriously in developed and developing countries. We should not relax our ethical standards to achieve our goals! They should be maintained and adapted to the needs of developing countries.

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Listening to Graphs & Hearing Diagrams

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Developments in Human-Computer Interaction have always exploited screen space, basing solutions around and emphasising visual output. In situations where the user's eyes are occupied, lack of screen space, or visual impairment, vision cannot always be relied on for optimum performance, in which cases information must be communicated through other means of presentation. Hearing is now a popular alternative and research into Auditory Display has provided evidences of its significant potential for successfully delivering information. We present an overview of the newly emerged discipline of Sonification and Auditory Display, briefly describing previous successes, current research in the field, and outline our approach for sonifying graphs and auditorally representing diagrams.

Keywords: sonification, auditory display, graphs, diagrams.

Introduction

What is Sonification?

Sonification is a term employed to describe the rendering of data relations using acoustically perceived means of presentation. Emphasising its function, Auditory Display can be defined as the presentation of sounds in a way determined by the nature of the data to be transformed, i.e. data-controlled sound [1] this includes the use of speech and non-speech sounds to represent information that is otherwise visualised. Just as data variables can be used to create visual displays allowing conclusions about a data set to be drawn from the employment of visualisation techniques, auditory presentation of information can also be computed to provide further and new perspectives on the data through listening. In some instances this can not be provided through other means of presentation.

Why Use Sound at All?

Our ability to extract meaning from sound is certainly a sophisticated one, the tying together of our perceptual and cognitive skills successfully manage to bridge a wide gap be-

tween the raw waveform of information that we receive at each ear and the rich semantic levels of meaning that we extract from it. The natural integrative properties of sound are increasingly being proved suitable for presenting high dimensional data without creating information overload especially in environments where changing variables and/or temporally complex information must be monitored simultaneously. Good common example of such can be seen in both spoken language and music. Think of a doctor's ability to understand the state of a patient using a stethoscope, or the ability of a trained mechanic to deduce the cause of a faulty engine from listening to how it sounds. Indeed, such sophisticated mechanisms allow us to make sense of current environmental settings and our complex interactions with it.

Success in Sonification and Auditory Display

Exploratory Data Analysis (EDA)

Possibly some of the thriving examples where sonification has been successfully im-

plemented lie in EDA. These are techniques that assist in detecting patterns, uncovering structures and extracting important variables anomalies in a given dataset. Due to the intricate nature of the data, in addition to the complex relationships that reside between data sets, much work on data exploration and analysis has tried to implement auditory displays to aid with these complex tasks proving that sonification and auditory display sometimes exceed the results that can be obtained when using visualisation alone. A fitting example of such situations would be in the medical domain where doctors routinely use sound for inspecting and analysing medical data, such as Electroencephalogram (EEG) records [2], or to monitor and analyse a patient's state while their visual focus is on the patient or elsewhere. More recently the sonification of the human genome project [3] has captured research interest where attempts to incorporate ideas from music perception has been used to create a sonification which shows trends in data. Equally as successful is the use of sonification in seismology. Here the motivation for using sound is the sheer volume of data which challenges traditional visualisation

techniques for data analysis. Seismologists are able to review 24 hours of data in about five minutes; significantly and positively affecting their performance [4].

Assistive Technology

Auditory display has found considerable success in assistive technology in which audition is used as a substitute sensory input to access information that is otherwise visual. Most of these technologies employ synthetic speech in the form of talking interfaces and screen-readers, by far the most widely used technology for accessing textual representations. Other technologies employ complex sonifications to enhance the non-visual interaction in a variety of contexts; a good example is the integration of non speech sound in the popular applications of spreadsheets [5]. These solutions provide evidence that the benefits of using sound can go beyond the obvious use of speech, especially in situations where the verbalisation of information will be inadequate, such as graphs and diagrams.

Listening of Graphs

Graphs such as line and bar charts are frequently used to present data in an easy to analyse way; an application where this is useful is in the analysis of trends and distribution of data which can be depicted more efficiently on a graph than on a table. Therefore, graphs are frequently used in finances, mathematics and numerous scientific fields. However, this kind of data visualisation technique is not so useful in situations where the user's eyes are occupied, lack of screen space, or visual impairment. Non-speech sounds can provide alternative ways to expose this information [6] [7] [8]. Research on auditory graphs presently use the knowledge gained from general sonification as a way of constructing sound graphs [9]. An example of this would be the systematic selection of sound parameters which would result in the most accurate mapping of the data. Some of the variables that researchers experiment with are different frequency, location, timbre, panning, tempo and duration.

Hearing Diagrams

While graphs typically convey numerical data, a diagram can depict concepts carrying semantics that are based on other types of data. Some forms of diagrams represent entities that, even though graphically situated, successfully convey meaning regardless of their spatial and graphical properties. The

graphical layout in such instances is simply an artefact of the presentation medium rather than an inherent part of the information [10]; i.e. it is only 'conveniently' visual. This raises the potential of using another modality to translate the concepts illustrated through a diagram, especially in situations where vision is no longer convenient. As the information is non-numerical, no direct mapping of data parameters into acoustic parameters can be used to represent such information auditorially. The challenge therefore is producing intuitive mappings using either or both speech and non-speech sounds to deliver perceptually comprehensible semantics of a given diagrammatic representation

Strategies combining different modalities have been explored in various research projects, such as [11] in which it was possible to translate technical diagrams and successfully communicate the information encoded in them. Sound has been proven particularly efficient in conveying hierarchical information [12].

Research Goals

Although research into sonification has seen considerable success, as a discipline and in comparison to its much more established counterpart field of visualisation, sonification and auditory display is still considered to be in its infancy. Our work aims to tackle some of the current challenges facing the design of efficient and usable auditory representations that are specific to graphs and diagrams. We are currently focusing on empirically evaluating the efficacy of employing different mapping strategies for sonically representing visual attributes with the aim of producing a methodical and evidence-based approach to mapping graphical characteristics into sound. We are also particularly interested in exploring the impact of learning effects on the ability to interpret and use auditory graphs and diagrams, both in individual and collaborative contexts, focusing on the use of sound as the main means of presentation and thus empirically assessing its potential as a medium of communicating the semantics and structure of diagrammatic representations.

Conclusion

Research into Sonification and Auditory Display investigates aspects of information presentation and accessibility when using sound as the main communication medium. One of the major questions in this field is to

establish appropriate and reliable methodologies for allowing alternative access to information that is graphically represented. Our work focuses on systematically studying the effectiveness of employing different strategies for representing graphs and diagrams sonically to support non-visual interaction with diagrammatic representations.

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SPEAKER ABSTRACTS

Abstract 1 **Publishing as an Engine for Change**

Abdelkader ESSAFI, President of IBScientific

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Publication is a measure of academic achievement, and a measure of the standing of academics among their peers. The importance of this activity is not well appreciated in the developing countries and their input in this field is very limited, though they have human resources that can deliver. With the advent of easy access to global information, a venue for e-publishing has emerged, and few years later Open Access paradigm has attracted some supporters that made it one of the best models of publishing. Open Access allowed higher citation, easy and free access, as well as high quality. For the developing countries, the obstacles are still there as they have to pay on average £1000 to be published even in open access or other publishing models. This prompted a need for other newer modes of publishing that do not charge for publishing

and/or access. One problem though remains, how would this kind of publishing generate its revenues? One solution is to establish a charity that can support this type of publishing, but its activities can extend to funding research, collaboration and other related activities. We call this initiative IBScientific.

About the Speaker

Abdelkader Essafi is a research fellow at the Department of Oncology, Imperial College London. He is working on Leukaemogenesis.

Abdelkader read genetics at University College London where he graduated in 2003. Currently, he is finishing his PhD at Imperial College London.

Abstract 2 **Mimicking Nature**

Dr. Mokhtar NIBOUCHE

Bristol Robotics Laboratory
School of Electrical and Computer Engineering
University of the West of England
Bristol, United Kingdom

In their quest for survival, animals make use of a broad range of sensory specialisations, each dedicated to solve a specific type of adaptive problems. Either simply for

About the Speaker

Dr. Mokhtar Nibouche is a senior lecturer in DSP and digital systems at the school of electrical and computer engineering, University of the West of England. He is also affiliated to "Bristol Robotics Laboratory", a research facility involving researchers from UWE and university of Bristol. His field of interests includes traditional and neuromorphic signal processing, image processing, reconfigurable computing and embedded systems.

Dr. Nibouche holds an "Ingeniorat d'etat" and a "Magistere" in electrical engineering from "Ecole Nationale Polytechnique d'Alger" and a PhD in Computer Science from "Queen's University of Belfast".

communicating, navigating, looking for food, hunting or avoiding predators, the use of these sensory capabilities across different species is very impressive. Bats, for example, use a highly sophisticated, well tuned echolocation system to localise moving preys in totally complete darkness. The operation consists of comparing an emitted sound with its echo to localise and identify moving entities. Hence, the main sensory input to the bat's central nervous system (CNS) is the ear. To solve a variety of adaptive problem, the rodent family of mammals (e.g. rats) has been equipped with a different sensory tool, which helps them to orientate, as well as to discriminate differences in fine surface textures in either complete darkness or visually occluded environments. This extremely sophisticated sensory specialisation is largely due to a

very advanced tactile based sensory system derived from their facial vibrissae (array of whiskers). The behavioural cues discernable by the whiskers include among others proximity, relative velocity, size and texture of close range surfaces and/or objects.

The main target of intelligent and autonomous robotic is

to design and build autonomous agents by copying animal behaviour in order to solve daily life problems. This in return will require expertise in different fields including digital electronics, signal processing, adaptive computing, biology and zoology, only to name few.

Abstract 3 Issues and Challenges Arising from the Application of a New Culture of Learning, Networks and Partnerships in Algeria

Dr. Mohamed SAAD

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Algerian institutions, organisations and businesses are operating in an increasingly complex and uncertain environment, broadly associated with the transition from a centralised and planned economy to a market economy. The situation has forced upon them the need to adopt policy initiatives aimed at restructuring all sectors of the economy. It has also required them to reassess all administrative, political and managerial rules and procedures in order to create the appropriate climate for restoring a sustainable development.

A careful analysis of prevailing conditions would reveal that such a success is often associated not only with effective and continuous learning and innovation, but also with a culture of sharing and partnership in which individuals and organisations operate within networks to achieve a greater mutual advantage. Organisations and institutions from developing countries, such as Algeria, whose technological capability and knowledge production systems are not well developed towards achieving a sustainable development will simply lose their international competitiveness.

The situation can appear even more distrustful as a result of the serious unequal patterns of expenditure on global knowledge production systems. The OECD countries account for roughly 85% of total world expenditure in science and technology; India, China and the East Asian NICs account for 10%; and the rest of the world for the remaining 5%. This means that for the majority of countries in the developing world, existing knowledge production and dissemination systems are inadequate to deal with rapidly changing patterns of development and globalisation. In order to challenge the global 'knowledge divide', organisations from developing countries need to become more linked to national and international business and research networks.

This paper, which is essentially based on the theories of resource-based view and social capital, focuses on knowl-

edge as the basis of firm growth and competitiveness. These theories which originally focused on the role of internal capabilities have now been extended to include resources that cross the boundaries of organisations or countries. This can provide organisations from developing countries opportunities to tap into systems of innovation and give them access to a wider range of solutions to technological problems. The more social capital an organisation develops in the relationship, the more likely it is to acquire new knowledge and exploit it as a basis of competitive and sustainable advantage.

However, there is clear evidence suggesting that most developing countries are still characterised by inappropriate learning approaches and a lack of culture of partnership and sharing. One of the main objectives of this paper is to highlight, through the Algerian experience, the main issues and challenges for the development of technological capabilities through a new culture of learning, networks and partnerships. The paper also intends to investigate the conditions for Algerian universities to play an active role in the promotion of innovation and the emergence of a learning society. It will also discuss the theories underpinning this research.

About the Speaker

Dr. Mohammed Saad is a Reader in Innovation and Operations Management. He was Head of School of Operations and Information Management at Bristol Business School, from September 1998 to August 2005. He has a degree in Economics with Management studies from Oran University (Algeria), an MSc in Operational Research from Sussex University and a PhD from the University of Brighton. His teaching, research and consultancy activities focus on innovation, learning, supply chain management and technology transfer. Dr. Mohammed Saad is leading a research team from Bristol Business School which is investigating Innovation in Procurement. He is also investigating the relevance of the Triple Helix model of innovation in developing countries and has contributed to the European Tempus and Medcampus programmes in North Africa. Mohammed is co-founder and co-editor of a new journal 'The International Journal of Technology Management and Sustainable Development'.

Abstract 4 **Structural Fire Safety Engineering: The Way Forward**

Prof. Ali NADJAI

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Synopsis

This article highlights the need for advanced testing facilities to provide sufficient test data that support the designer to build up the necessary engineering assumptions and to cover the uncertainties based on better understanding for the different types of structures behaviour in fire. In addition to that, it also helps to expand the modelling capabilities which currently play major roles in producing performance-based design solutions. The article also introduces a collaboration model for much needed closer working relationships between academe and industry to enhance the engineering solutions.



Figure 1: The effects of fire in tall buildings

Introduction

Fire is recognised as a significant hazard in the service life of a structure (Figure 1). Therefore there is a clear need to provide an improved understanding of the performance of materials and structures in fire and to provide clear design guidance in order to progress cost effective design. Within the past 10 years sophisticated computer programs have been developed, which mathematically predict the worst case fire scenario, provide the optimum

evacuation procedure and represent the behaviour of a steel frame in fire. However, the use of these programs remains limited by the lack of relevant test data, requiring the designer to provide the necessary engineering assumptions to cover all the uncertainties; and this further limits the modelling capabilities. This article highlights the issues of providing much needed test information and the need for closer working relationships between academe and industry. Collaboration has the potential to provide essential research data in several areas currently lacking sufficient knowledge. It will also underpin the expertise of UK designers and suppliers within the construction industry.

About the Speaker

Professor Nadjai has built a distinguished career in the field of fire safety, becoming a respected researcher and author in this field. Professor Nadjai was educated at Annaba University (BEng (H), Heriot- Watt University (MSc) and the University of Sheffield (PhD). After three year working as a research Fellow in Nottingham Trent University, Professor Nadjai joined the University of Ulster in 1995 as a Lecturer and was promoted to Reader in 2000.

Professor Nadjai conducts his research at the university's internationally acclaimed FireSERT facility. He is a member of many learned bodies including the Fire Engineering Research Network, the EPSRC Peer Review College, the British standard Institution and the European Technology Construction Platform. He has published over 85 papers in books, journals and conferences.

Research Grants

Awarded several sources of grant from EPSRC, EU Funding and industrial research development bringing a total contribution to £7 Million pounds since 1996.

Abstract 5 **Neurobiology of Pain: The Good, the Bad and the Ugly**

Dr. Laiche DJOUHRY

Department of Physiology, Medical School
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Pain is an extraordinary event and despite its unpleasantness, it is an important part of the existence of humans and other animals; in fact, it is vital to survival as It alerts us to avoid or minimize tissue damage. Indeed people born with congenital insensitivity to pain usually have

short life spans, and suffer numerous injuries. While the absence of such sensations is catastrophic, the persistence of pain is debilitating.

Pain can be divided into acute pain and chronic pain.

Acute pain is experienced immediately after a painful stimulus. This is a physiological (normal) pain and is 'good' because it plays a protective role and acts as a warning system or device to warn us of immediate threats and this is why it is sometimes referred to as a warning pain. The cause of acute pain is usually known and it can originate from both external and internal organs and it resolves spontaneously.

Unlike acute pain, chronic pain lasts for 3-6 months or longer, but it can last for years or even lifetime and becomes an illness itself rather than a symptom of a disease. Chronic pain can be either inflammatory "bad" associated

with tissue injury/inflammation or neuropathic "ugly" associated with nerve injury/dysfunction. This type of pain is abnormal and is bad/ugly because it serves no useful function and its cause is often not easily identified (multifactorial). It is characterized in humans by spontaneous pain, allodynia (pain in response to a normally non-painful stimulus, e.g., touch as when you have tissue inflammation) and hyperalgesia (exaggerated pain to a normally painful stimulus).

Persistent or chronic pain is one of the most common problems in primary care. Although it is so common, tremendous efforts have been devoted to understanding its mechanisms. It is not clear how to best treat chronic pain especially that associated with nerve injury (neuropathic pain). The reason for the problem may have been that researchers using animal models of chronic pain were studying the wrong symptoms. Indeed most previous animal studies have exclusively measured evoked pain behaviours (allodynia and hyperalgesia, see above for definition) and have not studied spontaneous pain which is the most important aspect of human neuropathic pain as it is the primary complaint of neuropathic pain patients. Unlike these studies we have recently shown for the first time that it is undamaged (intact) nerve fibres that cause ongoing spontaneous pain and not the damaged nerve fibres. In this talk we will discuss these novel findings.

About the Speaker

Dr. Laiche Djouhri has a DES in animal biology and graduated from the University of Constantine, where he has always been fascinated by the physiology of the nervous system. He got his PhD from the University of Sheffield in 1991 where he worked on neurophysiology with a particular focus on the central nervous system. He then worked as postdoctoral researcher at the University of Edinburgh for five years investigating how sensory information is processed at the level of the spinal cord. Then he moved to Bristol in 1997 and mostly stayed there since. He is now a Wellcome-Trust senior fellow. His current work relates to pain research and has a particular interest in the role of primary sensory neurons in chronic pain. His most recent paper published in the Journal of Neuroscience has a substantial impact on the research in this field and has attracted a lots of media coverage.

Abstract 6 Road Map to Polymer Engineering in Algeria

Prof. Hadj BENKREIRA (CEng, FICChemE)

Personal Chair in Coating & Polymer Processing
Associate Dean Research & Knowledge Transfer
School of Engineering, Design & Technology
University of Bradford
United Kingdom

Polymers, only recently (shortly after World War 2) manufactured in large scale worldwide, have revolutionized the way we live and interact with our environment. These macromolecules are the building blocks of plastics, coatings and pharmaceutical products and create much wealth and jobs throughout the world. They also stimulate new scientific discoveries and arguably there is much more to come from polymers. In this presentation, Prof. Benkreira gives an overview of Algeria's economy and industry which is largely oil and gas sale dependent- and proposes a road map for polymer engineering which will fuel new industrial activities in the country and help it create new employment opportunities. Prof. Benkreira will make available after the meeting a copy of his presentation.

About the Speaker

Prof. Hadj Benkreira is Associate Dean of Research and Knowledge Transfer at the University of Bradford School of Engineering, Design and Technology. He also holds a Personal Research Chair in Polymer Processing and Coating Technology and leads the Advanced Materials Engineering Research Group in the school which is renowned nationally and internationally for its excellence in research in polymer engineering. The University of Bradford is the home of the UK Interdisciplinary Research Centre of Polymer Science and Technology and the Yorkshire Forward Centre of Industrial Collaboration of Polymer Engineering. Prof. Benkreira has been carrying out research in this area for over 25 years and has a distinguished record of over 100 publications on various aspects of this subject. Prof. Benkreira is Member of the UK EPSRC Peer Review College, a Chartered Engineer, and a Fellow of the IChemE, a Director of the International Society of Coating Science and Technology and a co-founder of the European Coating Group.

POSTER ABSTRACTS

Abstract 1 **Biologically Inspired Hardware Systems: Increase survivability and solve complexity of Chips in Silicon**

Elhadj BENKHELIFA, Gabriel DRAGFFY, Anthony PIPE and Mokhtar NIBOUCHE

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Nature, with its complex structures and behaviours, especially in multi-cellular organisms, continues to inspire mankind in the field of engineering. Biological organisms, for instance, involve highly complex features and behaviours through a miraculous and well organised cooperation of a huge number of principle actors called the cells. In this work we try to evaluate and apply novel, biologically inspired processes and algorithms for implementing reliable and optimal VLSI systems on silicon. These Algorithms mimic the Embryological phase in multi-cellular beings for self-repair and self reproducing (Embryonics) and for fault tolerance mechanisms; they try to mimic the human Immune System (Immunotronics). Another type of algorithms mimics the evolution process in nature (Evolvable Hardware). They are used to automatically design digital circuit for better performance and more compact systems than human engineer. Such systems, similar to their bio-

logical equivalents, adopt the POE (Phylogeny, Ontogeny and Epigenesis) model, which demonstrates methods of progression in the development of existence. This model has been proposed as an alternative inspiration to both conventional hardware design paradigms and traditional fault tolerance methods. It introduces a new generation in electronic systems, which is termed Biologically Inspired Hardware Systems. These systems mimic nature in order to increase survivability and solve complexity. In the above context, this article introduces the state-of-the-art on Biologically Inspired Hardware Systems. It also discusses the possible limitations of human design in Embryonics and Immunotronics. Finally it proposes the use of evolutionary computations techniques in Embryonics, seeking alternative solution with more compact architecture and enhanced fault tolerance.

Abstract 2 **Spontaneous Neuropathic Pain Behaviour is associated with increased frequency of spontaneous activity in uninjured nociceptive C-fibre neurons after axotomy of adjacent spinal nerve**

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University of Bristol, United Kingdom

The causes of spontaneous pain, an important aspect of human neuropathic pain (pain associated with nerve injury), are poorly understood. Spinal nerve lesion (SNL) models of neuropathic pain including the L5SNL model (axotomy of lumbar 5 (L5) spinal nerve) cause allodynia (pain in response to normally non-painful stimuli) and hyperalgesia (exaggerated pain in response to painful stimuli), but spontaneous foot lifting (SFL), a sign of spontaneous (ongoing) pain in animals, is rarely reported.

SFL is, however, consistent in a modified L5SNL model (mL5SNL) involving L5SNL plus loose ligation of the adjacent L4 spinal nerve with chromic gut (which causes nerve inflammation). To determine the cause of SFL, spontaneous activity in nociceptive-type (pain) dorsal root ganglion (DRG) neurons was compared in L5SNL and mL5SNL models. One week after surgery, L4 but not L5 DRGs showed a significantly increased percentage (from 7 to 35%) of C- but not A-fiber nociceptive (pain)

neurons with spontaneous activity in mL5SNL animals. This increase was similar in both models, and thus not solely responsible for the SFL seen only in rats with mL5SNL. A similar change occurred after hindlimb inflammation, suggesting inflammation (resulting from degenerating L5 fibers) as a possible cause in these SNL models. One difference in spontaneous activity between the two models that could account for the increased SFL in the mL5SNL animals was a much faster rate of spontaneous

firing in adjacent L4 C-fiber nociceptive (pain) neurons in mL5SNL (1.8 H) than in L5SNL rats (0.08Hz). This increased firing rate in C-neurons with spontaneous activity in mL5SNL animals may result from enhanced inflammation and/or mechanical damage caused by the L4 loose ligation. Thus spontaneous activity, possibly induced by inflammation, in uninjured fibres whose peripheral branches are intermingled with injured nerve fibres in the sciatic nerve, may be important in spontaneous pain.

Abstract 3 Applications of Social Networks in Virtual Universities: A Semantic Web Perspective

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The evolution of e-learning technologies has led to the recognition of what we now know as a virtual university. A virtual university is one that delivers courses online using synchronous and asynchronous technologies to enable and support active and collaborative learning approaches. It also provides secure information management system and efficient information flowing. The term virtual university is sometimes used to describe an open-learning institution that uses the Internet to create an imaginary university environment in which students, faculty, and staff can communicate and share information at any time, regardless of their location. The research in this PhD is concerned with the type of virtual universities that has its learners, teachers and staff physically located in different places (countries) in the world, in other terms, a multi-cultural virtual university¹.

However, with the great potential that virtual universities promise to e-learning come great problems that have been holding the development of such universities for a while. Most of these problems are due to the different educational systems adopted by different educational cultures within different countries or even within the same country. Some of these problems are the differences among: the content of courses; the terminology used in both teaching and administration; the course organisation that different educational systems use, such as modules, credit, assignments, exams and sequence of learning design; communities' management for collaborative learning; and providing a good mechanism for searching for educational material (locating resources).

Another serious problem is the large number of distrib-

uted learners that results in a serious lack of the social life which is considered to be a principal element in the process of learning. In other terms, the need for social groupings increases as every student in the institution will need friends who share the same interests, preferences or learning experience; and as the number of students in these kinds of systems is very large, social groupings must be generated automatically and dynamically.

In addition to that, as learners will require more customized services to fit their needs, personalization becomes crucial in these environments. Thus, this research is concerned with the study of social networks and communities of practice within the virtual university environment and how can social networks solve the personalization problem.

The need for building communities of learners does not just aim at facilitating collaborative learning; but rather investigated the various applications of social networks in virtual universities. The study of social networks and communities of practice is not a new topic. However, as the use of the Internet grows wider and the nature of the Web changes more towards the new "Web of people", more researchers and hence more technologies are involved to support this study, making it the hottest topic on Web research. At this point, and as the application of the Semantic Web² –the future of the web- comes to a start; the recognition of E-learning in the semantic age becomes far beyond ignorance. Similarly, the potential of the Semantic Web can benefit the development of virtual universities in many ways, and the study of social networks within this environment in particular; including generating the

¹ The results of this research can be easily applied to the infrastructure of any multi-cultural virtual university, which offers support to any project of this kind that involves Algerian Universities as a partner.

² The semantic web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation -from: Berners-Lee, T., Hendler, J. and Lassila, O.: The Semantic Web. Scientific American, 284(5):34-43. 2001.

networks automatically and dynamically.

In this research, I investigate the different aspects of employing the Semantic Web within virtual universities, the different aspects of generating social networks within

virtual universities, the different roles of communities of practice and how they can be used to accomplish personalization, and the use of semantics to achieve these roles effectively.

Abstract 4 **Cyclooxygenase-2 (COX-2) upregulation in hypoxia: a mechanism for adaptation to low O₂ levels**

Abderrahmane KAIDI and Christos PARASKEVA

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University of Bristol, United Kingdom

One of the models for colon cancer development predicts that cancer results from the accumulation of intrinsic genetic and epigenetic changes, which alter signalling pathways that regulate cell proliferation, differentiation and cell death as well as a selection process imposed by environmental and microenvironmental factors, which lead to clonal evolution. Cyclooxygenase-2 (COX-2), the rate-limiting enzyme for prostanoid biosynthesis, is abnormally expressed in most colorectal cancers and several lines of evidence suggest an important role for COX-2 in colorectal tumorigenesis. Although COX-2 upregulation during colorectal tumorigenesis can be a consequence of aberrant growth factor signalling and oncogene activation, the role of microenvironmental factors such as hypoxia remains to be elucidated. We report that under conditions of low oxygen tension (1%O₂, hypoxia) COX-2 protein levels increase in colorectal adenoma and carcinoma cells. Rigorous analyses suggest that COX-2 upregulation in hypoxia is transcriptional and is in tightly linked to the induction of hypoxia inducible factor-1 α (HIF-

1 α). Furthermore, we demonstrate that HIF-1 α specifically binds to a hypoxia responsive element (HRE) on the COX-2 promoter. COX-2 upregulation during hypoxia results in increased levels of prostaglandin E₂ (PGE₂), which acts to promote tumour cell survival under hypoxic conditions. Additionally, elevated levels of PGE₂ during hypoxia enhance vascular endothelial growth factor (VEGF) expression and HIF-1 transcriptional activity by activating the MAPK pathway, demonstrating a positive feedback loop that maintains COX-2 upregulation during hypoxia. This study identifies COX-2 as a direct hypoxia responsive gene in colorectal tumour cells. Also, COX-2 upregulation represents a pivotal adaptive mechanism to hypoxia with implication for enhanced colorectal tumour cell survival and promotion of angiogenesis. We propose the use of modified COX-2 selective inhibitors with preferential activation under hypoxic conditions as a novel more selective strategy for colorectal cancer prevention and treatment.

Abstract 5 **SAHARA Net: Seamless Adaptive Handover in Heterogeneous Radio Access Networks**

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We propose the SAHARA Net framework: a handover adaptation technique that enables seamless application mobility between disparate wireless networks. It provides uninterrupted access to mobile data services while the user roams across heterogeneous networks. The term "Heterogeneous Networks" refers to a set of networks that interoperate despite using different radio access technologies. They provide an inter-working framework that

allows wireless technologies to complement each other to provide true application mobility

New technologies have been introduced in an effort by network operators to capitalise on the explosive growth of internet data traffic and mobile telephony. Cellular technologies such as GPRS, EDGE, and UMTS offer data services on the move, but with limited data rates. Other data oriented technologies, such as WiFi and Bluetooth,

provide higher data rates, but are confined to designated hot-spots scattered around metropolitan areas, or within office buildings. Heterogeneous networks offer service continuity across network domains, through a set of interworking protocols that enable the transfer of control information across disparate access networks.

However, seamless application mobility across disparate wireless networks poses a major challenge because of the tight-coupling between mobility management techniques and the underlying access technology. IP-based techniques such as Mobile IP (MIP) provide link-layer independent mobility. Nevertheless, the lengthy handover delays associated with them –over 150ms- render them unsuitable for delay sensitive applications.

Enhanced variants of Mobile IP such as Fast MIP (FMIP) minimise the handover delays by anticipating the handover decision. However, the pre-handover signalling associated with these schemes imposes further constraints on the limited resources of the mobile terminal. The SAHARA Net's adaptive approach relieves these constraints by restricting the use of fast handover techniques only to cases where the application's Quality of Service (QoS) requirements require minimal end-to-end delays.

SAHARA Net enables seamless application mobility across heterogeneous networks while preserving the scarce resources of the mobile device. It uses low latency IP-based handover techniques to provide seamless mobility. It sits at the network layer between the application and the link layers, and facilitates the handover of the application's communication sessions across different wireless technologies.

The framework is invoked when a networked application is started. The framework retrieves the applications

QoS parameters and conveys them to the handover process. The handover process assesses these parameters and adapts its procedures accordingly. This adaptation process allows the framework to manage resources more efficiently according to the application's QoS requirements. It trades off faster performance for power efficiency when the application is delay insensitive thereby conserving the limited resources of the mobile device.

Program Insert

The rapid growth of internet data services combined with the resounding success of mobile telephony give strong indications that there is huge potential in mobile data services.

Popular multimedia applications such as music downloads, instant messaging and video streaming require high data rates and short end-to-end delays.

A conglomeration of wireless technologies including UMTS, WiMAX, WiFi and Bluetooth have been developed to cater for these requirements.

Heterogeneous networks provide an inter-working framework that allows wireless technologies to complement each other to provide true seamless application mobility.

SAHARA Net enables seamless application mobility across heterogeneous networks while preserving the scarce resources of the mobile device.

It trades off faster performance for power efficiency when the application is delay insensitive thereby conserving the limited resources of the mobile device.

Abstract 6 Ultra-fine Particle Deposition in an Anatomically 'Closed' Nasal Cast

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Nasal delivery of drugs has important advantages compared to injection and oral administration, and is being considered for a wide range of drugs with topical and systemic action. Traditional nasal delivery technologies are, however, trapped in the dilemma between achieving improved nasal distribution and limiting deposition in the lower airways. The closed cast models the posterior connection between the nasal passages persisting when the soft palate automatically closes during oral exhalation. Powder particles are released into the cast in airflow; enter one nostril via the sealing nozzle and exits through the other nostril. In this study fluorescein sodium particles with a mass median diameter of 34 μm (n=3), were aero-

solised into the nasal cast, using 5 different loading doses (100 mg, 20 mg, 5 mg, 2 g and 1 mg), the particles were then recovered from the different sections of the cast separately. Delivery to this cast showed a consistent high recovery using the five different doses: $101.8 \pm 2.2 \%$, $98.1 \pm 5.1 \%$, $96 \pm 1.4 \%$, $98.5 \pm 6.36 \%$, $88.7 \pm 6.1 \%$ respectively. Using the 100 mg loading dose, the aerosol reached the second nostril, reducing the dose leads to reduction of depositions areas. For the 1 mg loading dose, 90% of the material deposited in the entry front section of the nozzle. Highly consistent and reproducible results were obtained for all the deposition experiments, confirming the accuracy of the method and the assay. The nasal cast presents

the human nose up on exhalation, nasal delivery devices with this concept could minimize the risks and problems related to lung deposition occurring during conventional nasal inhalation from a nebulizer and open up a new

range of opportunities for nasal delivery of drugs.

Keywords: closed cast, nasal deposition, fluorescein particles, aerosol.

Abstract 7 **Gene Regulation of the Pregnane X Receptor**

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ReNeuron Limited

The Pregnane-X-Receptor (PXR) plays a central role in the transcriptional regulation of genes associated with compound metabolism, including CYP3A4, CYP2B6, GST-A2 and MDR1. Ligand promiscuity for activating PXR, combined with its large target gene set, allows PXR to act as a central regulator to changes in the fluxome, relating to both xenobiotics (many therapeutic agents are ligands for PXR), or endogenous chemicals (PXR target genes are involved in bile acid homeostasis, haem and cholesterol synthesis). PXR expression has been shown to be increased by several chemicals, and of particular interest are chemicals not traditionally associated with PXR target genes, such as the peroxisome proliferators. The aim of this study was to examine possible molecular mechanisms underlying this phenomenon.

Bioinformatic analysis of 2.2kp of DNA immediately upstream of the PXR transcription start site, using MatInspector Professional to interrogate the Transfac 4.0 database identified putative binding sites for numerous factors, suggesting PXR has complex promoter architecture. Next, this region was cloned into a SEAP reporter plasmid and a deletion series created (1.8kp, 1.5kp, 1.3kp, 1kp, 900bp, 600bp and 400bp anchored at the 3' end). HuH7 cells were transiently transfected and expression levels measured, to produce a map of positive and negative regulatory regions: Comparing this to the in silico assignments allows evidence-based predictions for the transcription factors involved in basal expression.

A putative binding site for PPARalpha was identified 1.3kb from the transcription start site, and shown to respond in a positive fashion to co-transfected PPARalpha protein. In addition, electromobility shift analysis demonstrated binding of nuclear protein to this site and disruption of the site via mutagenesis resulted in both reduced binding of protein, and reduced activation in the reporter gene assay.

In summary, we have used both in silico and in vitro approaches to characterise potential molecular mechanisms underlying PPARalpha mediated transcriptional activation of PXR expression.

Program Insert

The Pregnane X Receptor (PXR) is regarded as a central factor in the body's response to alterations in chemical levels: It is activated by a variety of chemically unrelated endogenous and exogenous compounds and regulates genes involved in their uptake, metabolism, and excretion. For PXR to act as a central mediator of body responses to chemicals, it would be important that these chemicals could also alter the expression/function of PXR itself, providing another level of control. The aim of this study was to delineate the molecular mechanisms underlying regulation of the Pregnane X Receptor gene.

Abstract 8 **Downhole Oil-Water Separation: An Innovative Technology To Improve Oil Recovery**

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The oil industry is facing an important challenge which is the increasing amount of water being produced with

oil. Lifting, treatment and disposal of the produced water represent significant costs for the operators and therefore,

new water management options are continuously being investigated.

Downhole oil/water separators are a relatively new technology developed and tested first in the early 1990s. A DHOWS tool separates water from the mixture at the bottom of the well and re-injects it back into the reservoir while pumping the oil to the surface. The DHOWS device does not only provide a water-free production, but may improve oil recovery as well. Furthermore, DHOWS can significantly reduce the environmental risks from disposing water at surface, especially with tougher restrictions that are likely to be legislated as a result of the various international protocols for environment.

This study aims to reveal the potential of using the DHOWS in order to improve the oil recovery while reducing costs. It describes the DHOWS technology and its advantages, with more focus on the hydrocyclone-type DHOWS. It also includes assessment of the main worldwide DHOWS installations; issues associated with these cases are also discussed. The technical and economical

feasibility of this technology is addressed for various regions in the world including Algeria, the supplier of 25% of the EU energy needs.

Implementation of the DHOWS technology was verified with numerical simulations using real field data. Results show a significant improvement in sweep efficiency while minimising water disposal. Optimising the installation time and injection pump was carried out through sensitivity runs along with economics analysis.

This successful modelling study shows that although still in its infancy, the DHOWS technology holds a tremendous potential to influence the oil industry in the near future. Many water management experts believe that the DHOWS could be an ideal alternative to the current strategies. In the meanwhile, this novel technology needs to be investigated further before it can be integrated into the production mechanisms at a worldwide scale (e.g. Algeria). The main drivers for developing this technique are to maximize the oil production while keeping the environmental impacts at comfortable levels.

RESEARCH ABSTRACTS

Abstract 1 **SiGe Virtual Substrates**

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SiGe virtual substrates have attracted a lot of interest due to their ability to substantially improve conventional microelectronic device performance, as well as allowing new concepts to be explored. In this project improvements to the quality of terrace graded Si_{1-x}Ge_x ($x = 0.2$) virtual substrates have been suggested. It was found that optimising the growth temperature and in situ anneal can lower both threading dislocation density and pile-ups.

Program Insert

In order to increase the speed of silicon devices, to meet customer demands, it is necessary to continually scale these devices down. However, fundamental problems will soon limit device scaling. Therefore, it is necessary

to incorporate new materials, which are compatible with current microelectronic fabrication processes, to enhance device performance and maintain the historical performance of CMOS technology. Germanium is one of such materials. Current research has led to the introduction of new silicon wafer, so-called "Silicon/Germanium virtual substrates VS". These virtual substrates are used to introduce global strain in integrated circuits, hence improving their performance. However defects and dislocations in the Virtual Substrates are deleterious to device operation and must be reduced. In this poster we describe possible techniques to improve the quality of the virtual substrates by optimising the growth conditions.

Abstract 2 **Verical External Cavity Surface Emitting Lasers**

Zakaria MIHOUBI

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Vertical-external-cavity surface-emitting lasers (VECSELs) are one of the most cost effective sources of picosecond pulses that are compatible with Ytterbium doped fibre amplifiers. The external cavity of the laser enforces low-divergence, circular, near-diffraction-limited, high quality beam and allows us to manipulate the laser output. The semiconductor gain sample active region is composed of GaAs with InGaAs strain-compensated quantum wells. The emission wavelength of this structure can be tailored by design. The quantum wells have a wide gain bandwidth which is ideal for ultra-short pulse generation, and spectroscopic applications.

At the University of Southampton, we are developing sources of higher power and shorter pulses in the parabolic regime by passively mode locking VECSELs using external cavity semiconductor saturable absorber mirror (SESAM). The result is a train of short pulses with high

repetition rate in the laser output. Sample characterisation is carried out on each sample by means of reflectivity measurements, photoluminescence measurements and lasing behaviour. In much of our work on the development of VECSELs, we use high gain, compressively strained InGaAs/GaAs quantum well system with an output wavelength in the 1- μ m region of the spectrum.

Abstract 3 **Attitudinal Determinants of Credit Cardholder Behaviour: An Empirical Study within the Financial Services Sector**

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This research attempts to provide a comprehensive examination of the attitude-behaviour relationship in a services setting and more specifically in the UK credit card sector. The findings did not support the central hypothesis that attitude and behaviour will correlate highly. Furthermore,

the findings support recent empirical work that found that “attitude might not have a unique effect on credit use” (Zhu and Meeks, 1994) and should be examined in conjunction with observable variables such as age, gender, lifestyle, socio-economics.

Abstract 4 **Investing in Immunosurveillance: Recruiting Immune Effectors for Tumour Immunotherapy**

Samira LAKHAL

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United Kingdom

Immunosurveillance is the process by which the immune system constantly responds to potentially malignant cellular changes. These cellular changes reflect the genomic instability that drives the progression into the malignant state. They represent danger signals that alert the adaptive immune effectors (such as cytotoxic T lymphocytes) and recruit them to the site of malignant transformation. Some current cancer research aims at characterizing such tumour-specific effectors and expanding them *in vivo* in order to halt tumour progression in a specific manner. This has proven to be a challenging task because of the numerous immune-escape mechanisms evolved by tumours, such as downregulation of antigen presentation and recruitment of immunosuppressive regulatory cell populations. Also, the heterogeneity of tumour antigen expression among patients implies that only a small proportion will benefit from vaccines targeting specific tumour antigens. Nonetheless, some vaccine-based therapies have yielded promising results and there is compelling evidence for the benefits of combining immunotherapy with conventional chemotherapeutic agents.

This research addresses the different approaches to tumour immunotherapy and cases where they have been successful. It also discusses current challenges such as overcoming the immunosuppressive environment created by the tumour and the identification of tumour-specific vaccine targets that would benefit a wider range of cancer sufferers. There is also scope for preventive immunotherapy

in high risk individuals such as those with an established family history of cancer occurrence. Eventually, immunotherapeutic approaches aim to induce highly specific and long-lasting tumour immunity.

Abstract 5 FoxO3a Regulates Bim Transcription in CML

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FoxO3a regulates diverse cellular processes including survival and proliferation, which are important for tumourigenesis. In haematopoietic cells, FoxO3a is highly expressed and its involvement in their homeostasis is not yet explored. In this research, we report FoxO3a as an important survival regulator of chronic myeloid leukaemia

cells downstream of the oncogenic Bcr-Abl fusion protein. FoxO3a directly bind and activate the gene expression of Bim in murine and human cell lines leading to cell death after the inhibition of Bcr-Abl using STI571. Knock down of either Bim or FoxO3a, abrogates this effect and protect cells from STI571 driven apoptosis.

Abstract 6 The Equivalence Between the DHP and DLP for Elliptic Curves Used in Practical Applications, Revisited

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In Cryptography, a number of problems are believed to be computationally intractable. Among these, are the problems called Discrete Logarithm Problem (DLP) and Diffie-Hellman Problem (DHP).

Let G be a finite cyclic group generated by g , and have order p , an odd prime number. The DLP is the problem of computing, from a given $h \in G$, an integer $\alpha \in \{0, 1, \dots, p-1\}$ such that $g^\alpha = h$; whereas the DHP asks for the value of g^{ab} given two elements $g^a, g^b \in G$ (a, b are unknown).

A natural question to ask is: Are these two problems really different? It is easily seen that if one can compute discrete logarithms then the DHP becomes easy: Compute a from g^a , then raise g^b to a . The remaining question now is whether knowing how to solve the DHP can help in solving the DLP efficiently. These two problems were theoretically proved to be computationally equivalent by Maurer in 1994, by showing how to solve any instance of the DLP granted an oracle that solves the DHP and the existence of an auxiliary elliptic curve over F_p with a smooth order. Muzereau *et al.* considered the special case where G arises from elliptic curves used in practical cryptographic applications and constructed suitable auxiliary elliptic curves. The paper builds on the latter and tries to get the tightest possible reduction. A new set of auxiliary elliptic curves was constructed for the aim of computing a better lower bound for the computational complexity of the corresponding DHP.

The main idea behind the method introduced by Maurer rests on representing elements differently: The implicit representation of an integer a (modulo p) is defined to be g^a . Maurer's reduction algorithm performs algebraic operations in the implicit representation instead of the usual explicit representation. In this representation, $a+b$ is computed with one multiplication in G : $g^a \times g^b$. For $a-b$, the result is $g^a \times (g^b)^{-1}$. However, to compute the implicit form of $a \times b$, a DH-oracle, that computes g^{ab} given g^a and g^b , seems to be necessary as no one knows how to do it otherwise! Using this oracle, we can also compute the representation of a^{-1} , and thus we can divide too, by using the fact that $a^{p-1} = 1 \pmod{p}$, and hence $a^{-1} = a^{p-2} \pmod{p}$. That is, given a DH-oracle for G , all algebraic algorithms can be converted to work in the implicit representation.

Now, to solve a DLP in G , Maurer's algorithm uses the DH-oracle to solve the problem in the implicit representation over some elliptic curve group $E(F_p)$, which is constructed to have a smooth order, in order to make the DLP over it easy to solve.

If the DLP is assumed to be exponentially hard in G then this reduction shows that the protocols whose security relies on the difficulty of the DHP in the same group are as secure as those based on the DLP. This also provides a lower bound for the computational difficulty of the DHP.

Abstract 7 Ethnic Differences in Oxidative Stress Status in Type2 Diabetic Patients

Karima ZITOUNI, Diane HARRY, Jaffar NOUROOZ-ZADEH, John D. BETTERIDGE and Kenneth A. EARLE

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United Kingdom

Patients of African (AC) origin compared with Caucasians (CA). A potential biological explanation for this observation is related to oxidative stress. We measured plasma vitamin E by HPLC, lipid hydroperoxide (LOOH) by the FOX-2 assay and circulating transforming growth factor beta-1 (TGFbeta-1) by ELISA in relation to changes in renal function over 3 years in 58 type 2 diabetic patients of AC (n=22) and CA (n=36) origin with similar baseline mean (SD) age, duration of diabetes, HbA1c, systolic blood pressure, plasma creatinine and median (range) urinary albumin excretion rate [62.1(7.8) vs 57.2 (10.7) years; P=0.07, 12.0(8.9) vs 10.0(9.3) years; P=0.43, 8.0(1.2) vs 7.3(1.5)%; P=0.08, 161.9(17.0) vs 145.5(23.7)mmHg; P=0.08, 107.3(16.2)

vs 97.1(19.2)umol/l; P=0.07 and 63.4 (11-133) vs 39.8 (22-89) mg/day; P=0.1]. There were no differences in TGFbeta-1 between the groups (P=0.26). LOOH and vitamin E lower in the AC compared with the CA patients [5.1(1.2) vs 4.3 (1.8)umol/l; P=0.02 and 29.8 (10.8) vs 41.2 (19.6)umol/l; P=0.01). Vitamin E correlated with the percentage fall in creatinine clearance in AC patients (P=-0.48; P=0.03) and after adjustment for baseline differences was an independent predictor of final plasma creatinine (t-3.17, P=0.003). Vitamin E as a marker of oxidative stress predicts the progression of nephropathy, and may partly explain disease vulnerability in patients of African origin.

INTERVIEW

Interview with **Professor Lord Martin REES**
Head of The Royal Society and
Master of Trinity College, University of Cambridge

Conducted at Trinity College, University of Cambridge by:
Mohamed Ali TEFFAHI, University of Cambridge

Prologue

The Royal Society and Lord Rees: A Delightful Encounter and a Learning Experience...



"The Royal Society has throughout its history supported the scientific community in its quest to improve knowledge about humankind and the universe around us. It has done this for the 'public good' because the acquisition and application of this new knowledge can lead to a better quality of life and an increase in prosperity. As it approaches its 350th anniversary in 2010, the Society remains committed to working with others to promote the best possible conditions for science to flourish, not just in the UK but also around the world, so that the improvement of knowledge can benefit people across the globe." Lord Rees, 2005

Sir Martin Rees: Official Citation

Lord Martin Rees, Astronomer Royal and Royal Society Research Professor at Cambridge University, is renowned for his extraordinary intuition in unraveling the complexities of the universe. He has been a leader in the quest to understand the physical processes near black holes and is responsible for major advances in our understanding of the cosmic background radiation, quasars, gamma-ray bursts, and galaxy formation. He has contributed to almost every area of cosmology and astrophysics and has been an inspiring leader, eloquent spokesperson, and patient guide for astronomers all over the world. Through his public speaking and writing he has made the Universe a more familiar place for everyone.

Professor Rees is a leader in understanding the structure and evolution of the universe. He contributed many of the foundational ideas about galaxy formation, particularly regarding the important role of gas and dissipation. In his quest to explain how the universe emerged from the cosmic "dark ages", he has examined how the first genera-

tions of stars, galaxies, and quasars formed and then ionized much of the universe. He made the first predictions about polarization and other detailed features of the cosmic microwave background.

Both within and beyond astrophysics proper, Professor Rees has had broad impact on how humans think about the universe. He has thought deeply about questions on the border between science and philosophy, why the universe has the characteristics that it has, and how humans as sentient beings fit into this universe. Through his books, papers, and his students, he has been tremendously influential in setting the research agenda and stimulating investigations in all the many fields he has worked in.

The Royal Society

The origins of the Royal Society lie in an "invisible college" of natural philosophers who began meeting in the mid-1640s to discuss the ideas of Francis Bacon. Its official foundation date is 28 November 1660, when 12 of them met at Gresham College after a lecture by Christopher Wren, the Gresham Professor of Astronomy, and decided to found 'a College for the Promoting of Physico-Mathematicall Experimentall Learning'. This group included Wren himself, Robert Boyle, John Wilkins, Sir Robert Moray, and William, Viscount Brouncker. The Society was to meet weekly to witness experiments and discuss what we would now call scientific topics.

In 1665, the first issue of Philosophical Transactions was edited by Henry Oldenburg, the Society's Secretary. The Society took over publication some years later and Philosophical Transactions is now the oldest scientific journal in continuous publication.

Now the Royal society is a dynamic institution working towards furthering its roles as an independent science academy, a learned society and a funding body.

The Interview

The idea of making an interview with Professor Rees for IBSscientific Magazine came out after attending one of his public lecture entitled “Science and Society in the 21st century”. It turned out that this professor of Astronomy is also a master of Trinity College, Cambridge and the president of the Royal Society.

The aim was to expose our ideas to one of the most distinguished learned societies in the world and learn from an experience of more than 300 years for advancing science and knowledge for the public good.

We met Professor Rees after the talk and he was kind enough to invite us to his home, the master lodge in Trinity College. It was a Saturday morning; we were excited and full of enthusiasm for meeting such a personality.

In the interview that we are inviting you to read, you should learn about the views of the Royal Society regarding the challenges facing science in the 21st century and its impact on humanity as a whole. If you are a student, you should learn about deep fundamental research and its purpose, collaboration, publishing and its role in advancing the scientific community. If you are an open access enthusiast, you should understand the stand of the royal society regarding this trend in the scientific literature. If you are a junior or senior scientist, an academic or a doctoral student, you should learn about the royal society itself, its work and progress from a society of twelve scientists to an academy of science comprising the epitome of excellence.

This society is an academy of science that has harboured two main tenets:

1. Drawing public closer to understanding and using current research
2. The backdrop of policies and the provider of solutions to the nation and its policy makers.

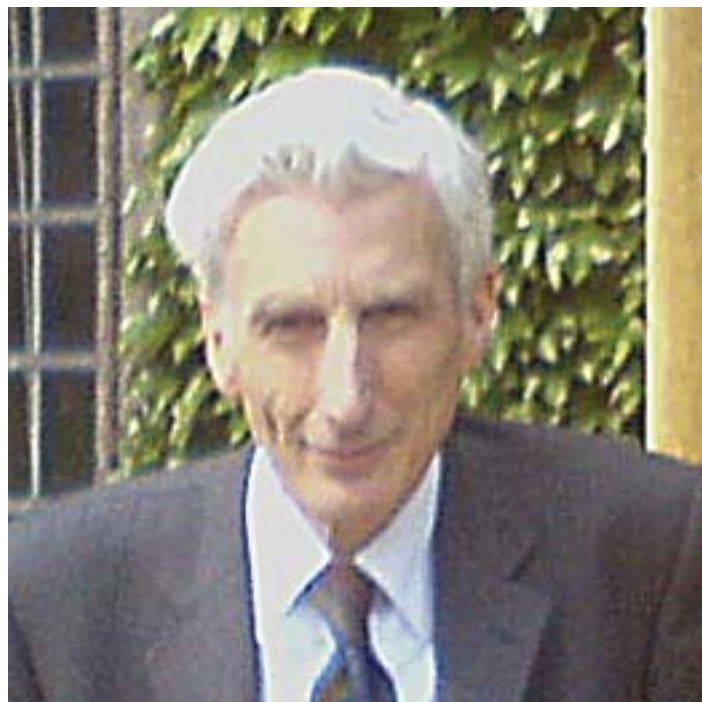
It did all of that through publications and meeting that enhanced collaborations lead to research and publication of research, and then fed directly in the prosperity of the nation.

We shall welcome you all to browse, and enjoy the interview and more importantly to learn and dream.

IBSscientific: First of all, thank you for accepting our invitation and taking part in this interview.

IBSscientific: As any PhD student who starts with a carrier in research, the main problem is always finding focus, finding direction and seeking advice. The other concern is how to publish and communicate information. So what do you think about these common concerns for research students?

Well, the most crucial decision is to take the right subject and the right adviser. And the best advice I'd give is to choose a subject where things are changing rapidly, with new emerging data, and modern techniques, where a student can make use of more powerful computers. The reason for this is, if one just tries to tackle the problems, which early generations tried and failed to solve, one would not get very far. You want to tackle the kind of problems that the previous generation never had a chance to tackle or to tackle problems with new techniques. So pick a subject where developments are proceed-



ing fast.

IBSscientific: Technology, scientific research and economics are so intertwined these days. As you have illustrated in some of your lectures, the stack of awareness and the focus of knowledge all consider humans at the end. What do you think should be the focus of science in the 21st century?

There is a tremendous range of challenges, as a physicist I am interested in the very large and the very small but the biggest challenge of all perhaps is, the intermediate scale or the very complex especially in the biological world. Sometimes people say that science is going to gradually halt to the big problems to be solved. This is quite wrong as the branches of science advance, their boundaries get longer and new problems come into focus just beyond the existing boundary. In fact many of the problems that we are now thinking about in my area of science could not have even been formulated 10 or 20 years ago. So we settle old controversies and we engage in new debates as new questions arranged by earlier advances.

IBSscientific: Your subject is of course cosmology?

Yes that's right, my subject is trying to understand how the universe has evolved from the big bang to its present state and this has been developing fast, mainly because of advancing technology making possible observations not just with visible light but with something of very very distant objects using telescopes on the ground and in space. Our advances depend only 5% on actual theory, and the remaining 95% is dependent on advances in technology.

IBSscientific: This leads us to the relationship between applied sciences and basic sciences. What are your thoughts regarding this?

They are linked together, which traditionally said that pure science virtue its applications but of course the reverse is equally true. New

technology allows new discoveries so there is a complicated interplay, we do not have any chance to making progress in science without technical advances in instruments and computer parts. And another point is that many of the most important advances in technology recently are environmentally and socially benign. Instruments like the tape recorder we are using now, are miniaturised; they are made with less raw materials, use less energy and make information widely available in the developing world so many of the modern developments in communications and information technology are exciting, they are amazing achievements of technology and they are also good for society.

IBScientific: **We have the new technology and advancement in telecommunication, which will lead us not only to rely on machines as observational instrumentations to look accurately on the phenomena, but more important to rely on other people in understanding the problems and getting more focus and establishing an atmosphere for collaborations. How can we collaborate more ethically and more efficiently to work on solving one problem?**

All the important problems involve collaboration of different kind of expertise and often different countries. I think it is very important that we should have a lot of discussion not only about individual scientific problems but also about what our priorities should be in science. The reason for this is that if we look at the way effort is deployed in science, we find it is deployed in an optimal way in many respects. Some subjects have had state support whereas others like tropical diseases, which are under researched compared to the rich cardiovascular and cancer; there we need redeployment of effort. There are many areas where we need more research particularly environmental issues, which concern the rest of the world, thus we need to have to discuss internationally about what the priorities should be.

IBScientific: **Speaking about finding focus, our focus in IBScientific is on the third world and we took our country, Algeria, as an example. Although Algeria is not a third world country per se in relation to life standards, Algeria falls into the third world in terms of scientific research and establishments. How can scientists be involved, in an objective way, in policy making for the common good in terms of scientific development?**

Of course the internet does allow people working in these countries to remain in contact with research and to interact with colleagues within other countries, which is a marvellous development of the last 10 years or so. I think a country like Algeria can learn for instance for the experience of India. India is an example of a country which in terms of average GMP per person is on a similar level but it did, of course for historical reasons, develop total education earlier on and of course it is now evident by having a great deal of high tech industry and development. I think it is perhaps an encouraging model because clearly Algeria has disadvantages compared to European countries but has more capabilities than countries like India, which shows what can be done.

IBScientific: **I like the example of India for, in fact, I am an admirer of your colleague professor Ammrat Assan and his interesting work on the welfare economics and the ethical economy. What do you think of his ideas at welfare economics in relation to science and technological embracement of these faiths?**

I think his main focus has been on the benefit of freedom of communication and political freedom and he emphasised very strongly that there is no conflict between those values, economic values, quality of life, and perfect stand as in many others he has seen a very positive influence indeed.

IBScientific: **Now we want to focus on your work in the Royal Society. We see the Royal Society as one of the excellent models for scholastic societies. It has a group of eminent scholars and distinguished scientist who try and put a certain direction for science and how society perceives science and the same thing for policy makers. What is the aim of the Royal Society in terms of science direction in this country and the world?**

The Royal society is of course the national academy for Britain and the commonwealth. It collaborates with many other academies in the UK and abroad and with other learning societies. Within the UK, it is concerned with the quality of education both at schools and universities. It is also concerned to provide the best policy advice to the government on the growing range of political decisions, which have a scientific dimension like energy, epidemics and environment. A growing part of our agenda has involved the interaction with academies of other nations and in connection with that I was in Moscow just two weeks ago with the heads of other academies from G8 countries who are preparing statements on issues like energy security and infectious diseases. Before the G8 meeting held in the UK, there were statements about global warming and about development capacity in Africa, which were supported by academies of the G8 countries, plus the academies of China, India and Brazil.

IBScientific: **It is interesting because these countries, China, India and Brazil, are emerging economies.**

Yes indeed, I think a growing number of issues where how can the academies collectively agree on statements. Even though scientists are only one part of any political decision, it is an important part and it is crucial that the decision should be made on basis of the best scientific advice. And therefore it is the duty of the academies as it is of individual scientists to engage in discussion with the wider public about all the aspect of science which has impact on public policy.

IBScientific: **In terms of the aims of the Royal Society regarding the advancement of science, what do you think of its role toward the third world? Is there any initiative for that?**

We have a number of exchanges, and we are members of the international academy council which contains academies from the developing world and the third world academy of science. Mohammed Hossam is the secretary general, who is an active participant. So we are very concerned to encourage the scientific development in those countries and particularly in Africa where it is very important not to focus just on primary education and provide basic needs, but also on tertiary education because without that you would not have the teachers and you would not stand the chance to be able to promote scientific institutes in Africa; and this will be essential in order to diminish the brain drain from Africa.

IBScientific: **Speaking about brain drain, although the most important power ball for the Africans is the economic power, Africa**

has managed to seal third world scientists, one of them is Nobel Prize winner Ahmed Zouail. There is also the president of NIH, Professor Elias Zerhouni. They say, the third world does not need big scientists, what it needs is those who put the bricks together to build the house. The real need is for people to go and do the work and perform. What are your comments on that?

Indeed, I think in order to encourage people to get educated and remain in those countries, there need to be some flagship projects. To give an example, the South Africans have just built a large telescope; a slightly irrelevant project compared to their needs. It has been used by the South African president as a flagship project to stimulate education and I think to show that exceptional things can be done in what is otherwise a fairly poor country. Such initiatives are going to raise moral to encourage young people for education and make them happier to remain there working in their countries provided that they keep contact with the world surrounding them by means of the internet.

IBScientific: To pin point science over the internet, we talk about open access publishing. What do you think of this model keeping in mind the success of the Public Library of Science (PLOS).

I think it is a good model, my only concern that some of the advocates of this model do not realise that someone has to organise the system and someone has to pay for the system, maintaining the archives and quality control and refereeing. So as long as that can be done in a way that's fair then the system is clearly a great advantage.

IBScientific: At the early steps of IBScientific initiative, the start up was not fuelled by money, but only the belief in the common good. This was a sort of adventure to myself, it was new endeavour for all of us. Thankfully, we all had a sense of devotion coupled with our beginner's luck as young researchers. It took some time for the project to take shape, and gather momentum with every new problem and issue we saw strength in the midst of the chaos. Enough poetry, but I thought I give you some sense of the project in our minds as the next question will be about an area that is charged emotionally and very controversial. For the final part of the interview, I would like, if I may, reflect upon on the direction of science as you always portrayed in your books. A question so philosophical, yet you approached it scientifically, it is ethics. One recent example that is likely to echo in the future is stem cell research. How do you describe the relationship between scientists and the general public? and how would this relationship affect scientists' relationship as experts with the policy makers? Any ethical issues to consider?

It is clear that science is advancing at a broad front and faces more and more difficult choices and more and more ethical decisions. This is due to a growing gap between the ranges of things that science can allow and what it should allow. The choices on how to apply science

should not just be made by scientists, but also the wider public for the reason it is very important for scientists to engage in debates with the public. For the first time the main threats come from human beings and not from nature, such as global warming, nuclear war and other threats due to unintended consequences of new technologies. So as science advances the stake gets higher and the opportunities become more exciting but the downsides also become more serious. It is more important to ensure that we make wise choices on how to apply science and there will be some ethical problems that we have to confront. The problem here is that when is it possible to have an international consensus because if we want to regulate this kind of research and kind of technology then it clearly does not work for only one country but it has to be done very widely. Also, even if all countries agree on the regulations then we have to make sure that they can be effectively enforced. And so those are real challenges I think.

IBScientific: We spoke about the idea of the culture of scientists, integrity and objectivity. Can you elaborate more on this?

Science should be a cooperative enterprise but it is also competitive and when commercial or political pressures become involved, that may distort the development of science and alter priorities, which creates a risk of people being tempted.

IBScientific: The final question would be, as a Master of Trinity College and an educator in this well established institute, what advice can you give us?

I think you should make use of available technology to develop international groups of young scientist who can cooperate and discuss not the research itself but also how to apply it and how to relate to teaching the next generation. The main problem is to educate the next generation and to ensure that the gap between the developed and developing world narrows and does not widen. Few people empowered by the technology like the internet can have a very big effect. It is easier for people to have a big effect in those countries than it was in the past and that is why I think you are doing this in an encouraging time and I hope you get every kind of support.

IBScientific: Thank you very much for your precious time.

Let's keep in touch!

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Conference on The Triple Helix Paradigm for Development: Strategies for Co-operation and Exchange of Good Practice

18-19 September 2006

Chair of the Organising Committee:

Dr. Mohammed Saad, Bristol Business School

Chair of the Scientific Committee:

Prof. Henry Etzkowitz, Business School, University of Newcastle

Specific themes to be addressed by papers:

The role of universities in developing, sharing and disseminating all forms of knowledge (explicit and tacit)

The University - Industry links

The role of triple helix model in the development of regional innovation of systems

Triple helix as a new paradigm to provide a sustainable basis for innovation and technological progress.

The implications of the 'triple helix paradigm' for the organization and management of the university system, and also for the modalities of technology transfer practices in developing countries

Foreign Direct Investments and transfer of Knowledge

The relevance of theories such as transaction cost, resources-based, value dynamic capabilities, social network and constraints, etc. to understanding the triple helix system

The theoretical basis for the triple helix system of innovation and sustainable development

Dates and deadlines:

15 July 2006: Submissions

31 July 2006: Feedback to Authors

17 September 2006: Registration and Meal

18-19 September 2006: Conference

Registration Fees:

Students: £75

Others: £150

For more information about the conference and funding options available, please visit the conference web site: <http://www.uwe.ac.uk/bbs/3helixconference> or contact the chair of the organising committee at mohammed.saad@uwe.ac.uk.



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